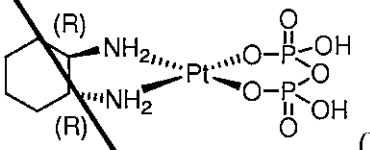
CLAIMS

What is claimed is:

1. A phosphaplatin complex selected from the group consisting of:

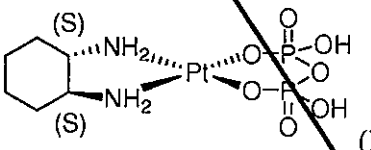
(i) enantiopure (1*R*,2*R*)-pyrodach-2 having formula (I),



(I)

or pharmaceutically acceptable salt or solvate thereof;

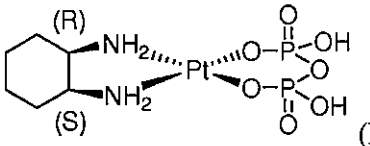
(ii) enantiopure (1*S*,2*S*)-pyrodach-2 having formula (II),



(II)

or pharmaceutically acceptable salt or solvate thereof;

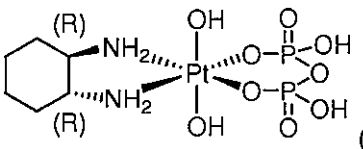
(iii) *cis*-pyrodach-2 having formula (III),



(III)

or pharmaceutically acceptable salt or solvate thereof;

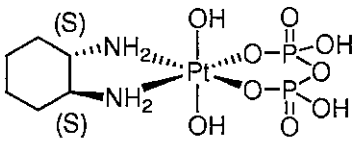
(iv) enantiopure (1*R*,2*R*)-pyrodach-4 having formula (IV),



(IV)

or pharmaceutically acceptable salt or solvate thereof;

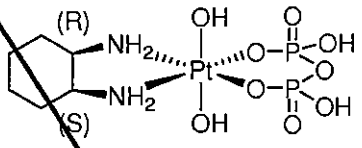
(v) enantiopure (1*S*,2*S*)-pyrodach-4 having formula (V),



(V)

or pharmaceutically acceptable salt or solvate thereof; and

(vi) *cis*-pyrodach-4 having formula (VI),

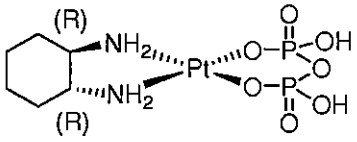


(VI)

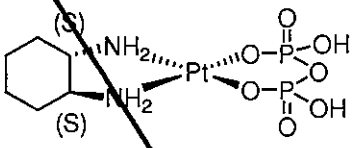
or pharmaceutically acceptable salt or solvate thereof.

2. A phosphaplatin complex selected from the group consisting of:

(i) enantioenriched pyrodach-2, having an enantiomeric excess of either (1*R*,2*R*)-pyrodach-2 having formula (I) or (1*S*,2*S*)-pyrodach-2 having formula (II):



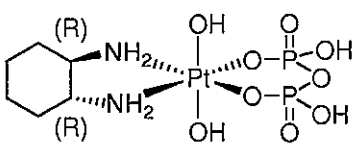
(I)



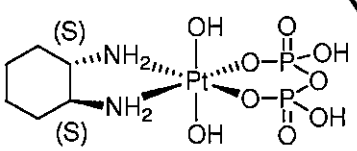
(II)

or pharmaceutically acceptable salt or solvate thereof; and

(ii) enantioenriched pyrodach-4, having an enantiomeric excess of either (1*R*,2*R*)-pyrodach-4 having formula (IV) or (1*S*,2*S*)-pyrodach-4 having formula (V):



(IV)



(V)

or pharmaceutically acceptable salt or solvate thereof.

3. The phosphaplatin complex of claim 2, consisting of enantioenriched pyrodach-2 having an enantiomeric excess of (1*R*,2*R*)-pyrodach-2 from 0.1% to 99%.

4. The phosphaplatin complex of claim 2, consisting of enantioenriched pyrodach-2 having an enantiomeric excess of (1*S*,2*S*)-pyrodach-2 from 0.1% to 99%.

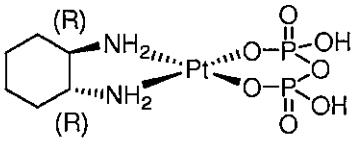
5. The phosphaplatin complex of claim 2, consisting of enantioenriched pyrodach-4 having an enantiomeric excess of (1*R*,2*R*)-pyrodach-4 from 0.1% to 99%.

6. The phosphaplatin complex of claim 2, consisting of enantioenriched pyrodach-4 having an enantiomeric excess of (1*S*,2*S*)-pyrodach-4 from 0.1% to 99%.

7. A composition for treating a proliferative disease, said composition comprising:

(a) one or more phosphaplatin complexes selected from:

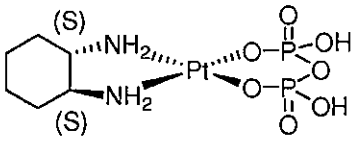
(i) enantioenriched pyrodach-2 having an enantiomeric excess of (1*R*,2*R*)-pyrodach-2 having formula (I):



(I)

or pharmaceutically acceptable salts or solvates thereof;

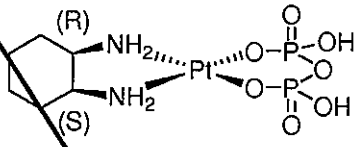
(ii) enantioenriched pyrodach-2, having an enantiomeric excess of (1*S*,2*S*)-pyrodach-2 having formula (II):



(II)

or pharmaceutically acceptable salts or solvates thereof;

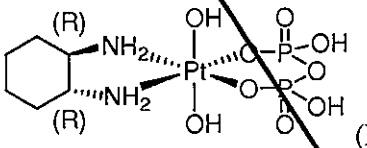
(iii) *cis*-pyrodach-2 having formula (III):



(III)

or pharmaceutically acceptable salts or solvates thereof;

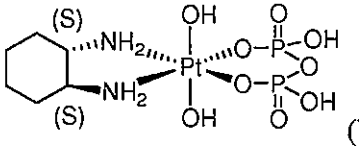
(iv) enantioenriched pyrodach-4, having an enantiomeric excess of (1*R*,2*R*)-pyrodach-4 having formula (IV):



(IV)

or pharmaceutically acceptable salts or solvates thereof;

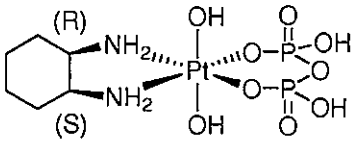
(v) enantioenriched pyrodach-4, having an enantiomeric excess of (1*S*,2*S*)-pyrodach-4 having formula (V):



(V)

or pharmaceutically acceptable salts or solvates thereof;

(vi) *cis*-pyrodach-4 having formula (VI):



(VI)

or pharmaceutically acceptable salts or solvates thereof; and

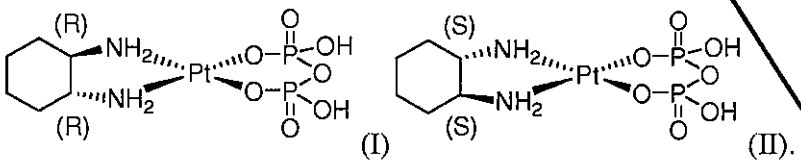
(vii) a multicomplex mixture of at least two of said phosphaplatin complexes (i)–(vi); and

(b) at least one pharmaceutically acceptable ingredient selected from the group consisting of carriers, diluents, adjuvants, and vehicles.

8. The composition of claim 7, wherein said phosphaplatin complexes are isolated, monomeric phosphaplatin complexes.

9. The composition of claim 7, comprising enantioenriched pyrodach-2 having an enantiomeric excess of from 10% to 100% of (1*R*,2*R*)-pyrodach-2.

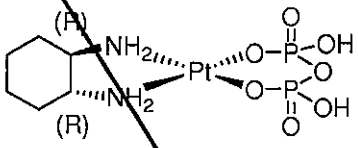
10. The composition of claim 9, wherein said enantioenriched pyrodach-2 consists of (1*R*,2*R*)-pyrodach-2 having formula (I) and (1*S*,2*S*)-pyrodach-2 having formula (II):



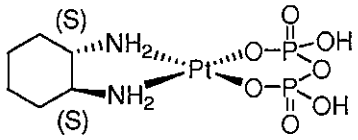
(I) (II).

11. The composition of claim 7, comprising enantioenriched pyrodach-2 having an enantiomeric excess of from 10% to 100% of (1*S*,2*S*)-pyrodach-2.

12. The composition of claim 11, wherein said enantioenriched pyrodach-2 consists of (1*R*,2*R*)-pyrodach-2 having formula (I) and (1*S*,2*S*)-pyrodach-2 having formula (II):



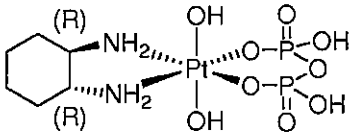
(I)



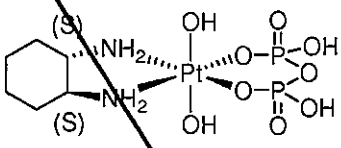
(II).

13. The composition of claim 7, comprising enantioenriched pyrodach-4 having an enantiomeric excess of from 10% to 100% of (1*R*,2*R*)-pyrodach-4.

14. The composition of claim 13, wherein said enantioenriched pyrodach-4 consists of (1*R*,2*R*)-pyrodach-4 having formula (IV) and (1*S*,2*S*)-pyrodach-4 having formula (V):



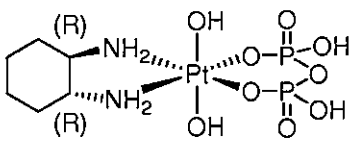
(IV)



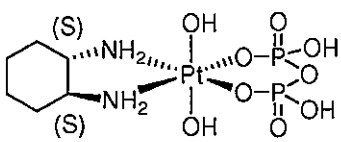
(V).

15. The composition of claim 7, comprising enantioenriched pyrodach-4 having an enantiomeric excess of from 10% to 100% of (1*S*,2*S*)-pyrodach-4.

16. The composition of claim 15, wherein said enantioenriched pyrodach-4 consists of (1*R*,2*R*)-pyrodach-4 having formula (IV) and (1*S*,2*S*)-pyrodach-4 having formula (V):



(IV)



(V).

17. The composition of claim 7, comprising *cis*-pyrodach-2.

18. The composition of claim 7, comprising *cis*-pyrodach-4.

19. The composition of claim 7, wherein said proliferative disease is a cancer.

20. The composition of any one of claims 7–19, wherein said proliferative disease is selected from ovarian cancer, testicular cancer, small-cell lung cancer, non-small-cell lung cancer, head-and-neck cancers, skin cancer, pancreatic cancer, breast cancer, glioblastoma cancer, and colon cancer.

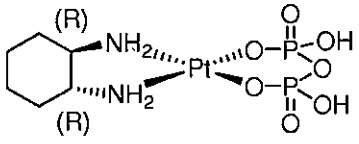
21. The composition of any one of claims 7–19, wherein said proliferative disease is a cancer resistant to treatment by at least one of cisplatin, carboplatin, and oxaliplatin.

22. A method of treating a proliferative disease, comprising:

administering to a subject in need thereof a therapeutically effective amount of a composition comprising:

(a) at least one phosphaplatin complex selected from:

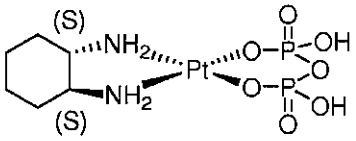
(i) enantioenriched pyrodach-2, having an enantiomeric excess of (1*R*,2*R*)-pyrodach-2 having formula (I):



(I)

or pharmaceutically acceptable salts or solvates thereof;

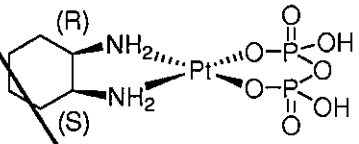
(ii) enantioenriched pyrodach-2, having an enantiomeric excess of (1*S*,2*S*)-pyrodach-2 having formula (II):



(II)

or pharmaceutically acceptable salts or solvates thereof;

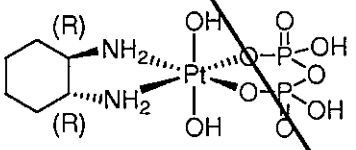
(iii) *cis*-pyrodach-2 having formula (III):



(III)

or pharmaceutically acceptable salts or solvates thereof;

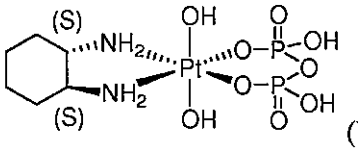
(iv) enantioenriched pyrodach-4, having an enantiomeric excess of (1*R*,2*R*)-pyrodach-4 having formula (IV):



(IV)

or pharmaceutically acceptable salts or solvates thereof;

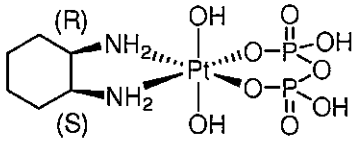
(v) enantioenriched pyrodach-4, having an enantiomeric excess of (1*S*,2*S*)-pyrodach-4 having formula (V):



(V)

or pharmaceutically acceptable salts or solvates thereof;

(vi) *cis*-pyrodach-4 having formula (VI):



(VI)

or pharmaceutically acceptable salts or solvates thereof; and

(vii) a multicomplex mixture of at least two of said phosphaplatin complexes (i)–(vi).

23. The method of claim 22, wherein said composition further comprises:

(b) at least one pharmaceutically acceptable ingredient selected from carriers, diluents, adjuvants, and vehicles.

24. The method of claim 22 or 23, wherein said composition comprises at least one phosphaplatin complex selected from the group consisting of:

(i) enantiopure (1*R*,2*R*)-pyrodach-2;

(ii) enantiopure (1*S*,2*S*)-pyrodach-2;

(iii) enantiopure (1*R*,2*R*)-pyrodach-4;

(iv) enantiopure (1*S*,2*S*)-pyrodach-4;

(v) *cis*-pyrodach-2; and

(vi) *cis*-pyrodach-4,

wherein:

said composition does not contain both (1*R*,2*R*)-pyrodach-2 and (1*S*,2*S*)-pyrodach-2; and

said composition does not contain both (1*R*,2*R*)-pyrodach-4 and (1*S*,2*S*)-pyrodach-4.

25. The method of any one of claims 22–24, wherein the at least one phosphaplatin complex of said composition consists of enantioenriched pyrodach-2, enantioenriched pyrodach-4, or both.

26. The method of any one of claims 22–25, wherein the at least one phosphaplatin complex of said composition consists of enantiopure (1*R*,2*R*)-pyrodach-2, enantiopure (1*R*,2*R*)-pyrodach-4, or both.

27. The method of any one of claims 22–26, wherein said composition further comprises cisplatin, carboplatin, oxaliplatin, or combinations thereof.

28. The method of any one of claims 22–27, wherein said proliferative disease is a cancer.

29. The method of claim 28, wherein said proliferative disease is selected from ovarian cancer, testicular cancer, small-cell lung cancer, non-small-cell lung cancer, head-and-neck cancers, skin cancer, pancreatic cancer, breast cancer, glioblastoma cancer, and colon cancer.

30. The method of claim 28, wherein said proliferative disease is a cancer resistant to treatment by at least one of cisplatin, carboplatin, and oxaliplatin.

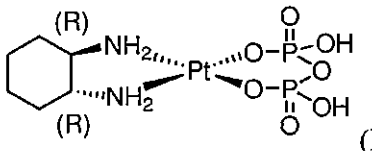
31. The method of any one of claims 22–30, wherein said subject is a mammalian animal.

32. The method of any one of claims 22–30, wherein said subject is a human.

Claims

1. A phosphaplatin complex selected from the group consisting of:

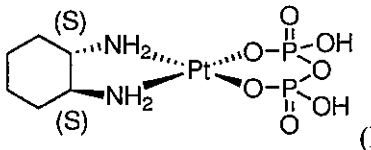
(i) enantiopure (1R,2R)-pyrodach-2 having formula (I),



(I)

or pharmaceutically acceptable salt or solvate thereof;

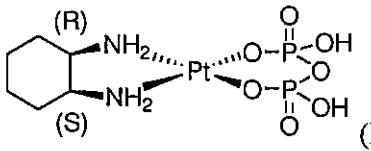
(ii) enantiopure (1S,2S)-pyrodach-2 having formula (II),



(II)

or pharmaceutically acceptable salt or solvate thereof;

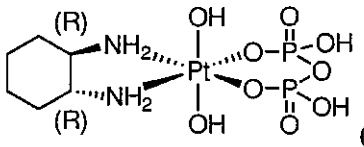
(iii) cis-pyrodach-2 having formula (III),



(III)

or pharmaceutically acceptable salt or solvate thereof;

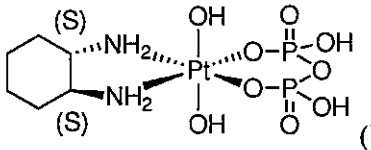
(iv) enantiopure (1R,2R)-pyrodach-4 having formula (IV),



(IV)

or pharmaceutically acceptable salt or solvate thereof;

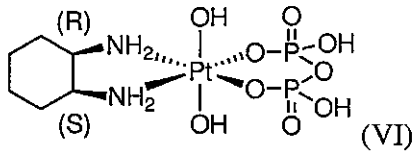
(v) enantiopure (1S,2S)-pyrodach-4 having formula (V),



(V)

or pharmaceutically acceptable salt or solvate thereof; and

(vi) cis-pyrodach-4 having formula (VI),

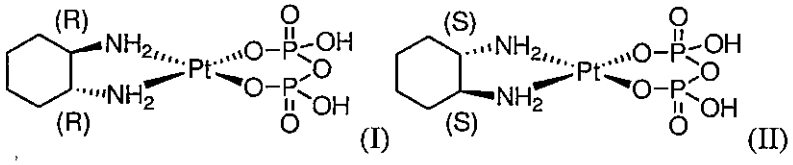


(VI)

or pharmaceutically acceptable salt or solvate thereof.

2. A phosphaplatin complex selected from the group consisting of:

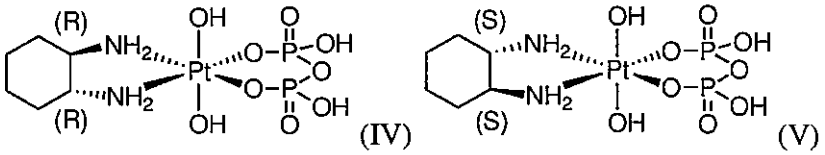
(i) enantioenriched pyrodach-2, having an enantiomeric excess of either (1R,2R)-pyrodach-2 having formula (I) or (1S,2S)-pyrodach-2 having formula (II):



(I) (II)

or pharmaceutically acceptable salt or solvate thereof; and

(ii) enantioenriched pyrodach-4, having an enantiomeric excess of either (1R,2R)-pyrodach-4 having formula (IV) or (1S,2S)-pyrodach-4 having formula (V):



(IV) (V)

or pharmaceutically acceptable salt or solvate thereof.

3. The phosphaplatin complex of claim 2, consisting of enantioenriched pyrodach-2 having an enantiomeric excess of (1R,2R)-pyrodach-2 from 0.1% to 99%.

4. The phosphaplatin complex of claim 2, consisting of enantioenriched pyrodach-2 having an enantiomeric excess of (1S,2S)-pyrodach-2 from 0.1% to 99%.

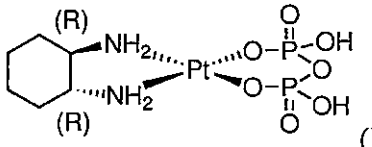
5. The phosphaplatin complex of claim 2, consisting of enantioenriched pyrodach-4 having an enantiomeric excess of (1R,2R)-pyrodach-4 from 0.1% to 99%.

6. The phosphaplatin complex of claim 2, consisting of enantioenriched pyrodach-4 having an enantiomeric excess of (1S,2S)-pyrodach-4 from 0.1% to 99%.

7. A composition for treating a proliferative disease, said composition comprising:

(a) one or more phosphaplatin complexes selected from:

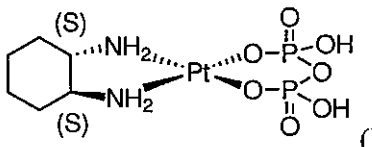
(i) enantioenriched pyrodach-2, having an enantiomeric excess of (1R,2R)-pyrodach-2 having formula (I):



(I)

or pharmaceutically acceptable salts or solvates thereof;

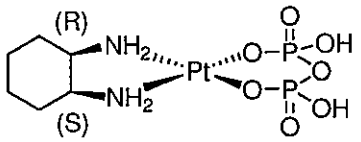
(ii) enantioenriched pyrodach-2, having an enantiomeric excess of (1S,2S)-pyrodach-2 having formula (II):



(II)

or pharmaceutically acceptable salts or solvates thereof;

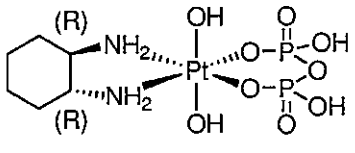
(iii) cis-pyrodach-2 having formula (III):



(III)

or pharmaceutically acceptable salts or solvates thereof;

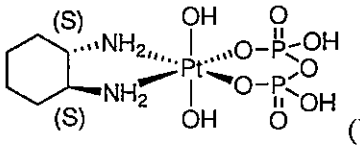
(iv) enantioenriched pyrodach-4, having an enantiomeric excess of (1R,2R)-pyrodach-4 having formula (IV):



(IV)

or pharmaceutically acceptable salts or solvates thereof;

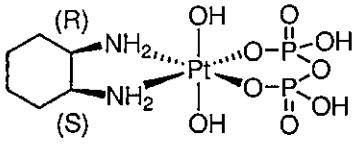
(v) enantioenriched pyrodach-4, having an enantiomeric excess of (1S,2S)-pyrodach-4 having formula (V):



(V)

or pharmaceutically acceptable salts or solvates thereof;

(vi) cis-pyrodach-4 having formula (VI):



(VI)

or pharmaceutically acceptable salts or solvates thereof; and

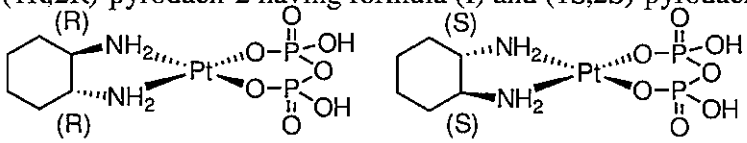
(vii) a multicomplex mixture of at least two of said phosphaplatin complexes (i)–(vi); and

(b) at least one pharmaceutically acceptable ingredient selected from the group consisting of carriers, diluents, adjuvants, and vehicles.

8. The composition of claim 7, wherein said phosphaplatin complexes are isolated, monomeric phosphaplatin complexes.

9. The composition of claim 7 or claim 8, comprising enantioenriched pyrodach-2 having an enantiomeric excess of from 10% to 100% of (1R,2R)-pyrodach-2.

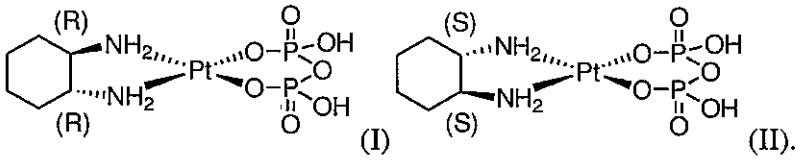
10. The composition of claim 9, wherein said enantioenriched pyrodach-2 consists of (1R,2R)-pyrodach-2 having formula (I) and (1S,2S)-pyrodach-2 having formula (II):



(I) (II).

11. The composition of claim 7 or claim 8, comprising enantioenriched pyrodach-2 having an enantiomeric excess of from 10% to 100% of (1S,2S)-pyrodach-2.

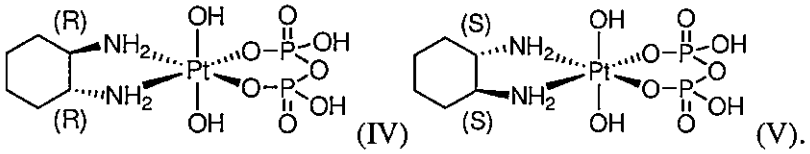
12. The composition of claim 11, wherein said enantioenriched pyrodach-2 consists of (1R,2R)-pyrodach-2 having formula (I) and (1S,2S)-pyrodach-2 having formula (II):



(I) (II).

13. The composition of claim 7 or claim 8, comprising enantioenriched pyrodach-4 having an enantiomeric excess of from 10% to 100% of (1R,2R)-pyrodach-4.

14. The composition of claim 13, wherein said enantioenriched pyrodach-4 consists of (1R,2R)-pyrodach-4 having formula (IV) and (1S,2S)-pyrodach-4 having formula (V):

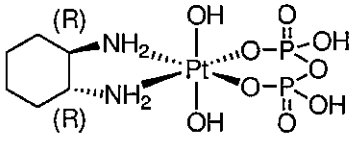


(IV) (V).

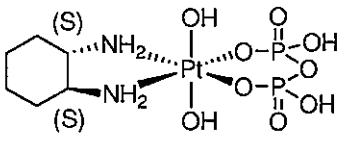
15. The composition of claim 7 or claim 8, comprising enantioenriched pyrodach-4 having an enantiomeric excess of from 10% to 100% of (1S,2S)-pyrodach-4.

16. The composition of claim 15, wherein said enantioenriched pyrodach-4

consists of (1R,2R)-pyrodach-4 having formula (IV) and (1S,2S)-pyrodach-4 having formula (V):



(IV)



(V).

17. The composition of claim 7, comprising cis-pyrodach-2.

18. The composition of claim 7, comprising cis-pyrodach-4.

19. The composition of claim 7, wherein said proliferative disease is a cancer.

20. The composition of any one of claims 7 to 19, wherein said proliferative disease is selected from the group consisting of ovarian cancer, testicular cancer, small-cell lung cancer, non-small-cell lung cancer, head-and-neck cancers, skin cancer, pancreatic cancer, breast cancer, glioblastoma cancer, and colon cancer.

21. The composition of any one of claims 7 to 19, wherein said proliferative disease is a cancer resistant to treatment by at least one of cisplatin, carboplatin, and oxaliplatin.